Section 20b

AZW/LA-II Low Alpha Inorganic White Thermal Coating

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Thermal Coatings

- ***Two Flight Thermal Coatings – White Paint***
  - ***Z93P White Paint: Calorimeter (S/N 032)***
    - *Current technology - control sample*
    - *Applied by Ms. Grace Miller / Swales Aerospace*
  - ***AZW/LA-II low alpha inorganic White Paint: Calorimeter (S/N 033)***
    - *New technology*
    - *Applied by Mr. Steve Jones / AZ Technology*
  - ***Both coatings developed by AZ Technology***
- ***Z93P White Paint (S/N 032)***
  - ***α = .17, εh = .87***
- ***AZW/LA-II White Paint (S/N 033)***
  - ***α = .11, εh = .86***
- ***Two Flight Thermistors***
  - ***Z93 (TCALEXP2T), LA-II (TCALEXP1T)***

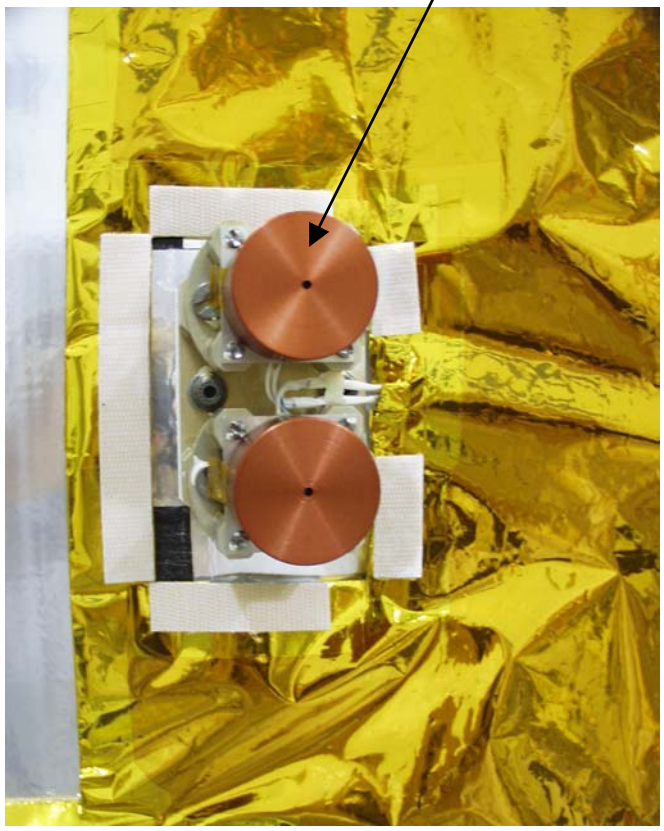
Z93 & LA-II Thermal Coating Samples

- ***Calorimeter paint samples provided to EO-1 by Dennis Hewitt, Head Thermal Engineering Branch, NASA/GSFC***
- ***Thermal Analysis and Design provided by Swales Aerospace***
- ***Calorimeter hardware built by George Harris of Swales Aerospace***
- ***The New Millennium Program's EO-1 mission provided a flight opportunity for verifying the LA-II white paint***
  - ***Calorimeters provided by NASA/GSFC with minimal cost to NMP***
  - ***Calorimeters had no direct impact on S/C performance***

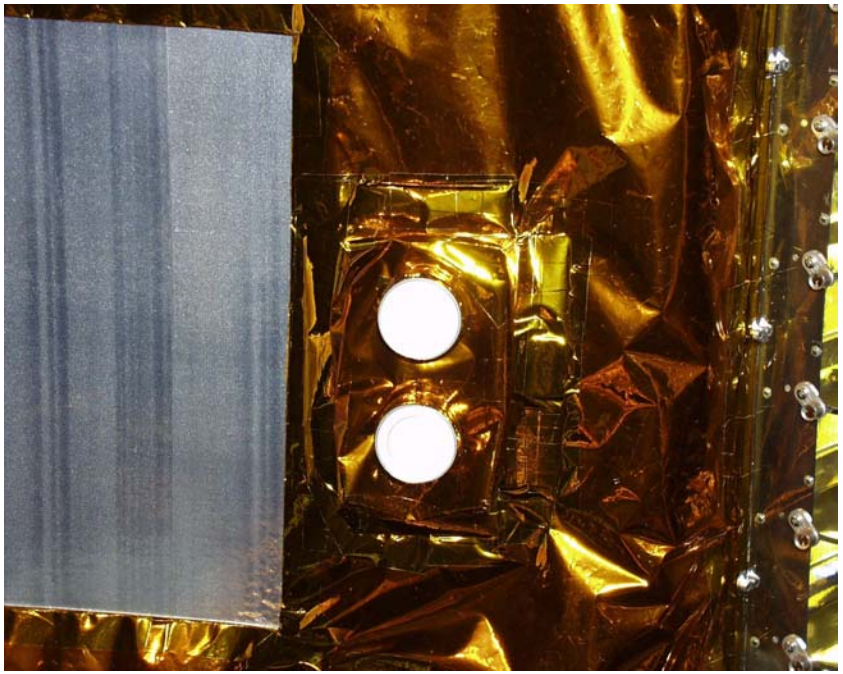
Calorimeters on EO-1

- ***The Calorimeters are mounted on a bracket and attached to the C-C radiator (Bay 4)***
- ***Carbon-Carbon Radiator consists of 1" Al honeycomb with 0.020" C-C face-sheets, approximately 28" by 28"***
- ***The LA-II coating ("low alpha") has a very low solar absorptance value when compared to other space application white paints***
  - ***A lower solar absorptance can provide improved radiator performance when exposed to UV. This improvement can lead to smaller radiator sizes, saving spacecraft mass***

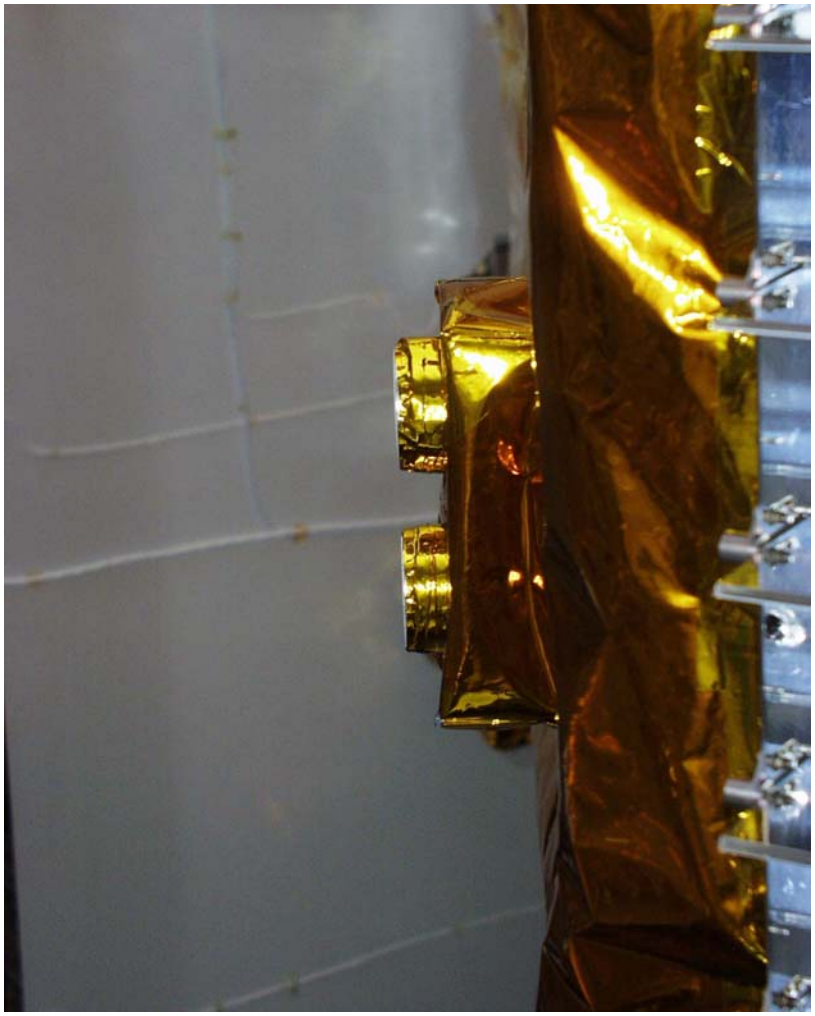
EO-1 Calorimeters



Pre-Flight Photos



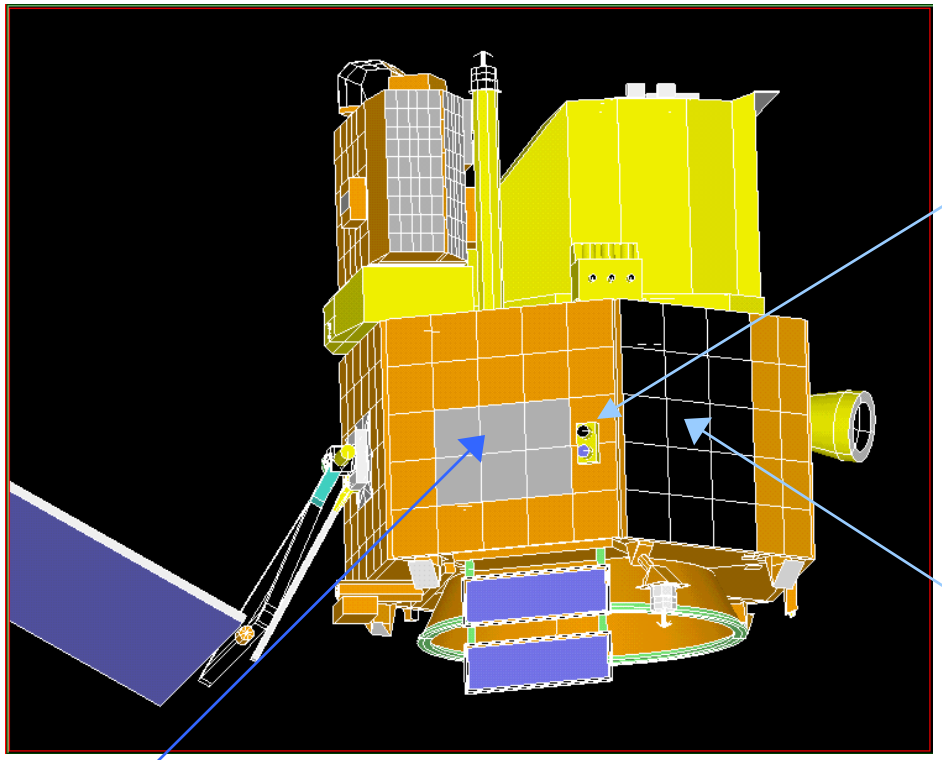
Pre-Flight Photos



LA-II White Paint Technology Validation

- ***Verify on-orbit thermal performance of thermal coatings and evaluate any degradation of properties (solar absorbtivity, α)***
  - ***Pre-Flight solar absorbtance and IR emittance measured by Wanda Peters/Swales Aerospace***
  - ***Thermal model correlated to test results and flight data***
  - ***Monitor calorimeter thermistor data on-orbit, along with S/C attitude data.***
  - ***Correlated flight data with calorimeter thermal model to verify properties and thermal coating performance***

TSS Geometric Math Model



Calorimeters

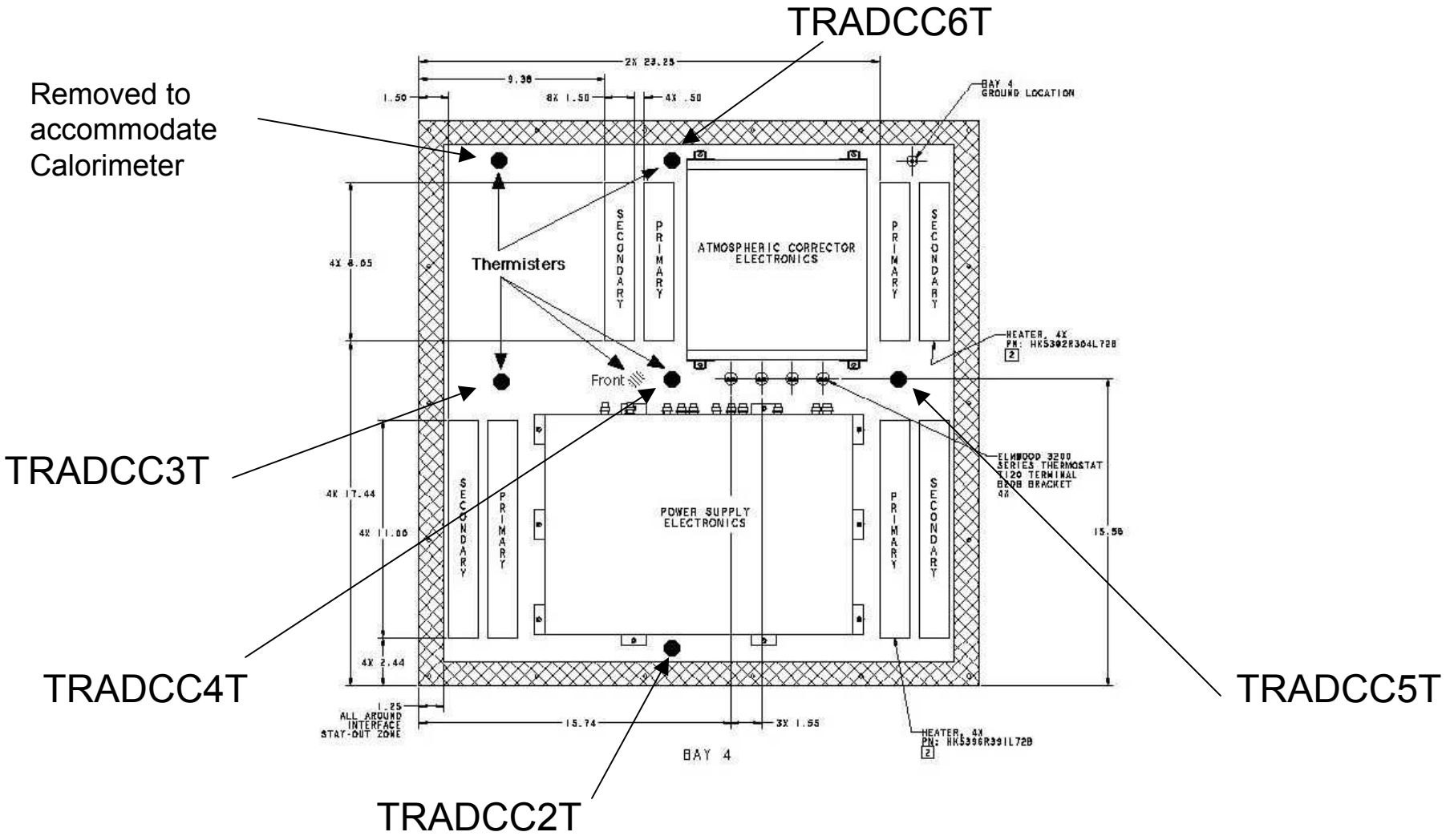
Louver

Bay 4 Radiator

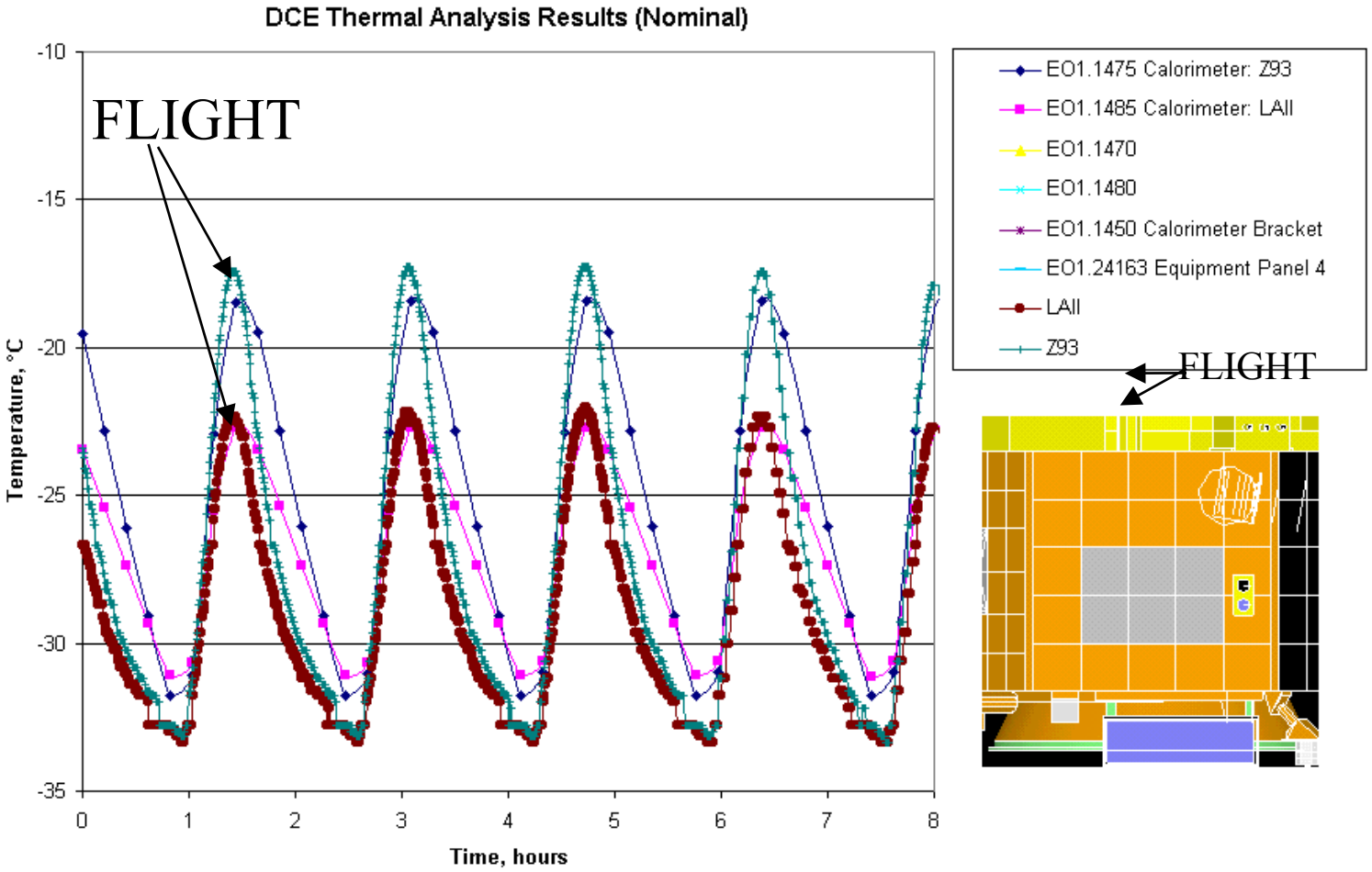
Validation Tasks Completed

- ***Component Level Tests***
  - ***Vibration and Strength***
    - *Structural Analysis and Modeling*
  - ***Mass Properties***
- ***Spacecraft Level Testing***
  - ***Vibration***
  - ***Thermal Vacuum***
- ***Special Flight Test (June 21,2001 through June 24, 2001)***
  - ***Maneuver EO-1 to have calorimeters Normal to Sun Vector for 25 minutes of Sun portion of orbit***

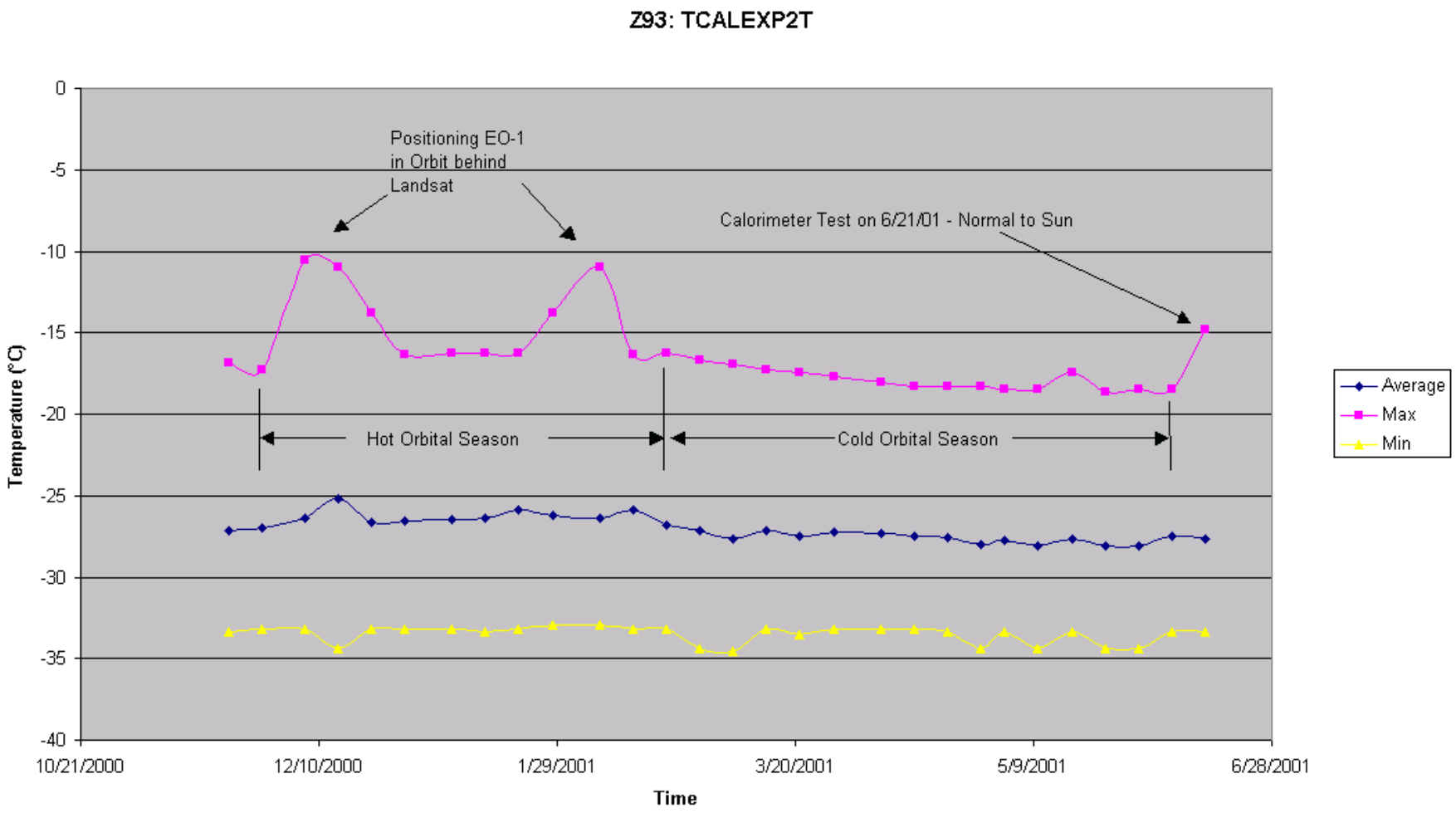
EO-1 Panel 4 Thermistor Layout



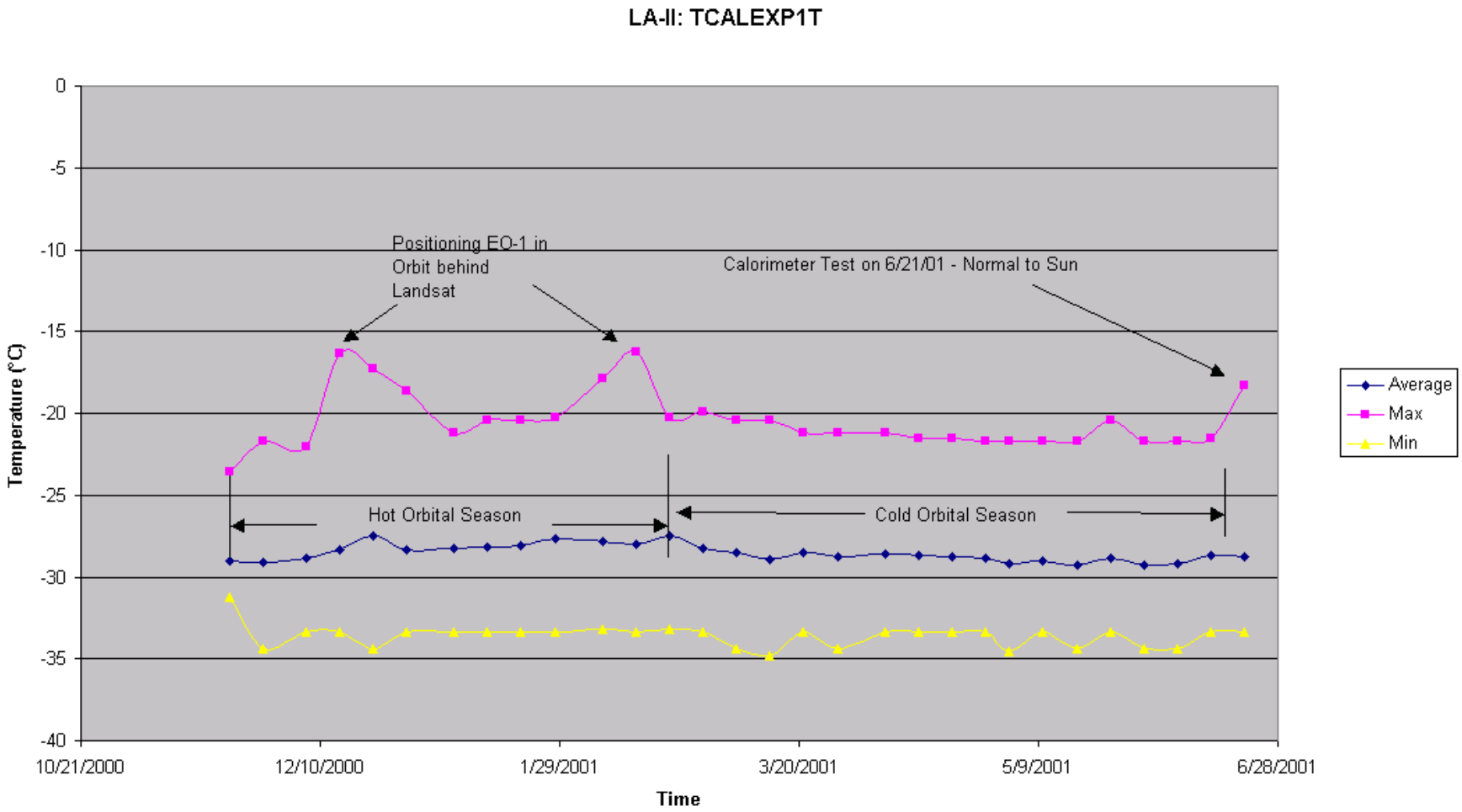
Transient Flight Data vs. Thermal Model Analysis



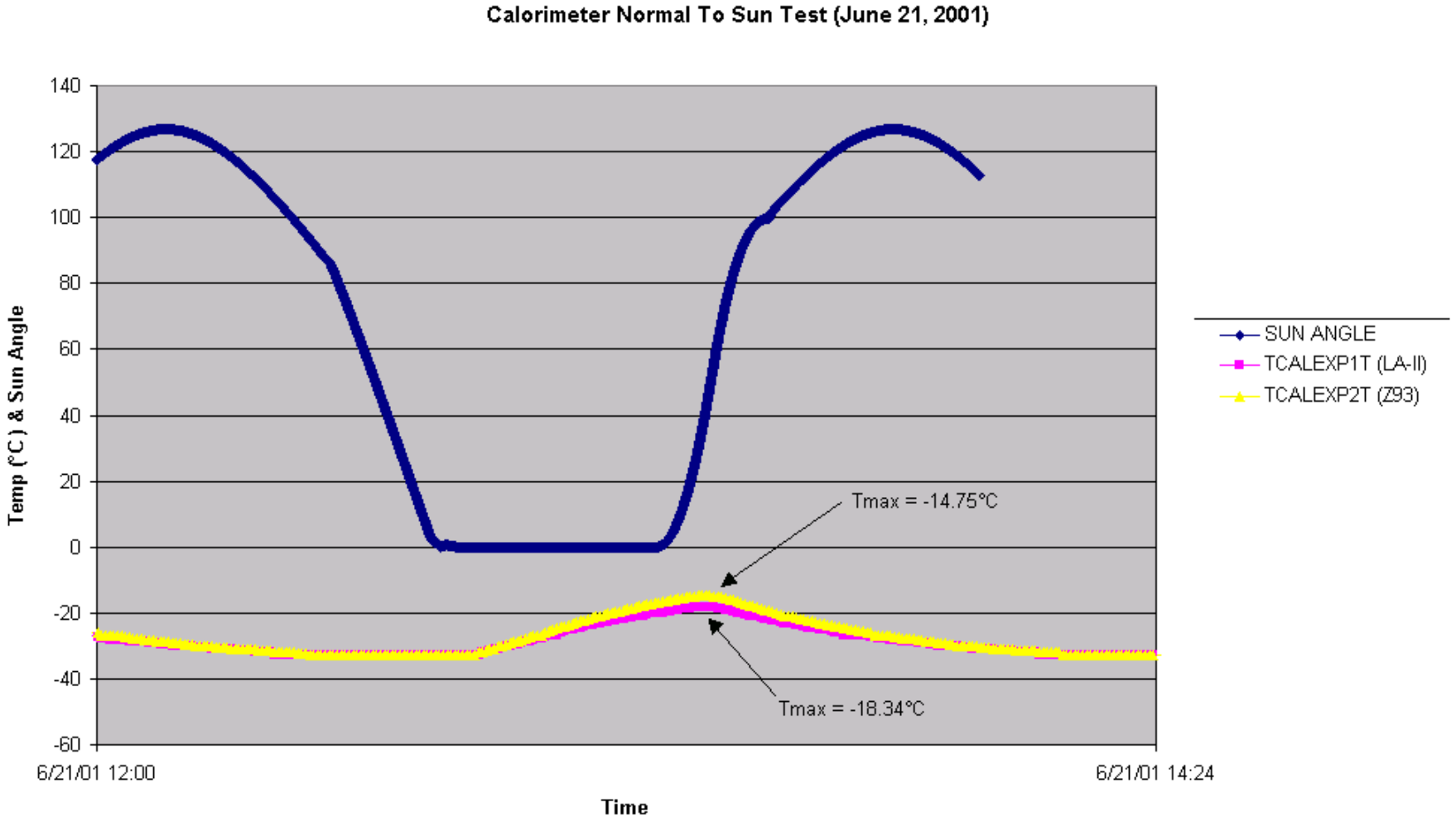
Z93: TCALEXP2T



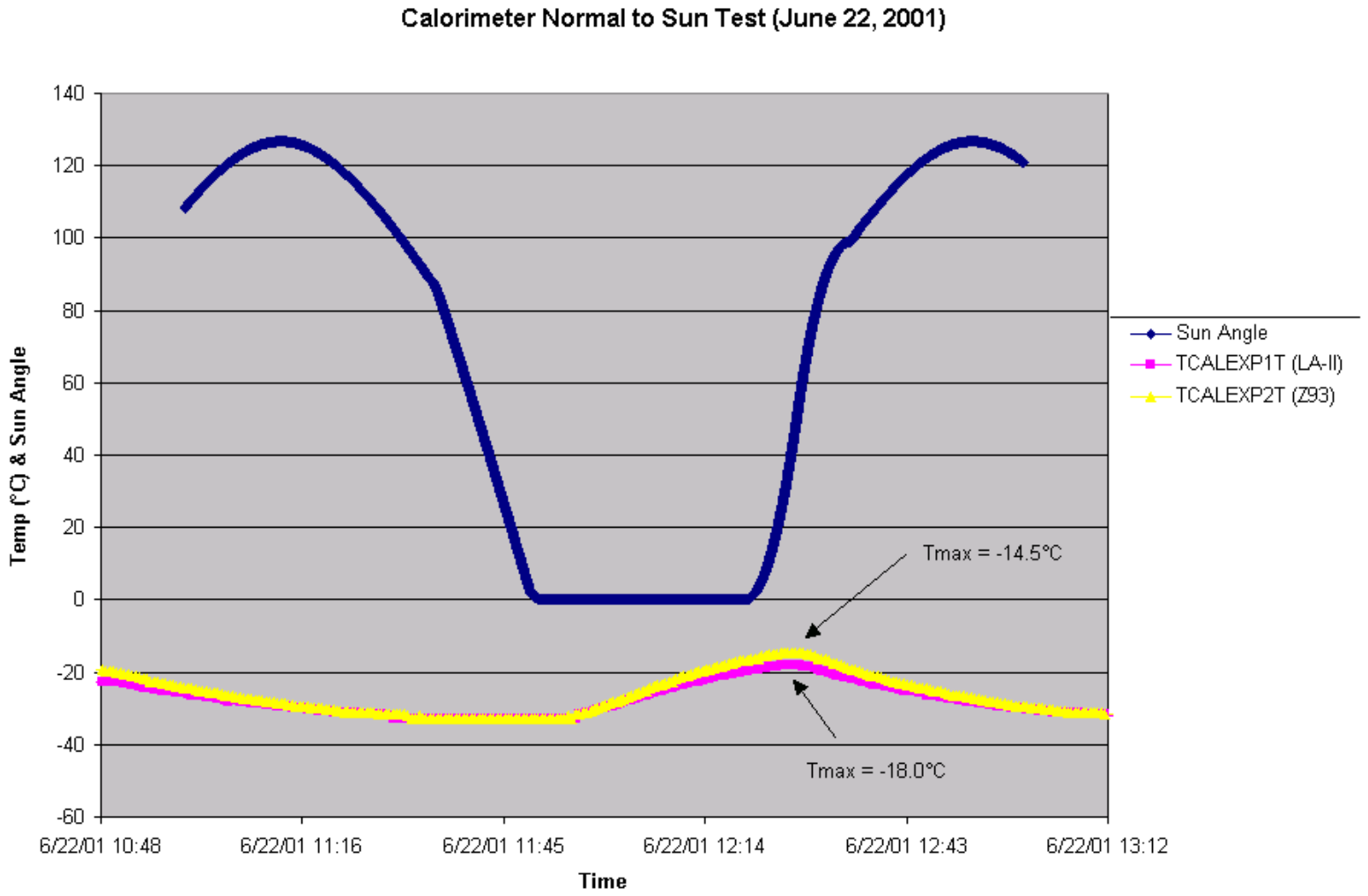
Z93: TCALEXP1T



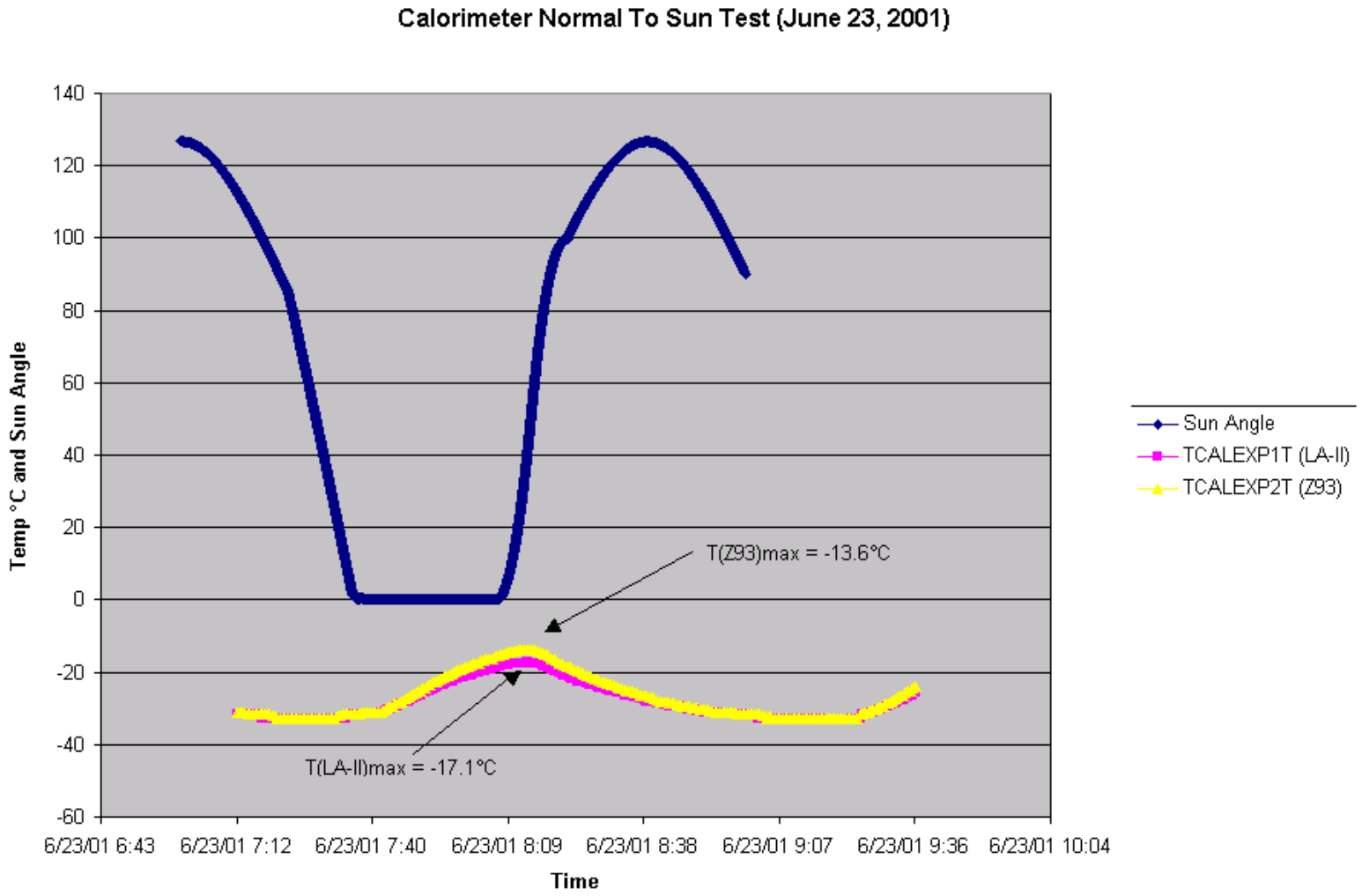
Calorimeter Normal To Sun Test



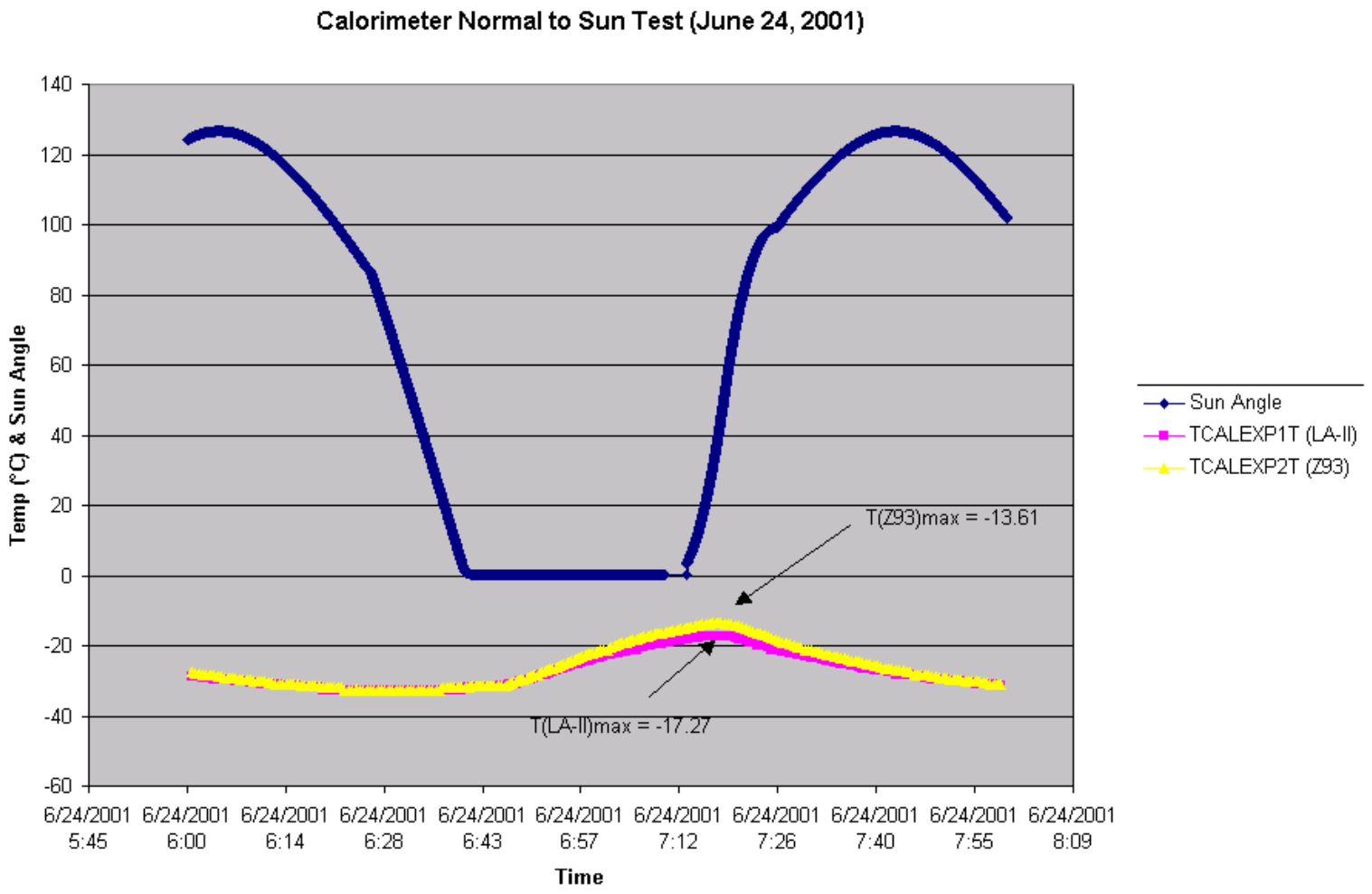
Calorimeter Normal To Sun Test



Calorimeter Normal To Sun Test



Calorimeter Normal To Sun Test



Lessons Learned / Summary

- ***LA-II optical properties verified maintaining stability with improved solar absorptivity vs. Z93***
- ***LA-II may provide cooler radiator temperatures when exposed to UV: (Data shows 5°C cooler in UV)***
- ***Follow calorimeters/samples through vibration testing. Extremely dirty environment which could contaminate thermal coatings***
  - ***We flew the spare calorimeters***
- ***Thanks to Dennis Hewitt at NASA/GSFC for his efforts in making the LA-II thermal coating a successful technology demonstration.***
- ***New coating now available to flight projects - baselined for the Swift spacecraft (but it is expensive)***